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DISCUSSION

LETTER FROM PROFESSOR POULTON

THERE are many points which it would be interesting to discuss in Mr. Francis B. Sumner's review of my book, "Charles Darwin and the Origin of Species."[1] I should, however, have abstained from troubling you were it not for Mr. Sumner's quotation of Professor Punnett's extraordinary misstatement of the modern Darwinian view.[2] For some time I had been intending to correct this curious blunder, and now that it has been quoted in your pages and even gives an ill-founded relief to Mr. Sumner, I feel that the time has come.

Professor Punnett is speaking of two African species of the Danaine genus, *Amauris,* respectively mimicked by two Nymphaline butterflies found in the same localities. The two Danaines are *Amauris niavius dominicanus* and *Amauris echeria;* the two Nymphalines, *Euralia wahlbergi* and *Euralia mima.* All four are figured on Plate VI., facing page 134 of "Mendelism." Mr. G. A. K. Marshall, in 1902,[3] suggested that the two *Euralias* are probably forms of the same species, but the proof was not finally obtained until 1909 when the late Mr. A. D. Millar, of Durban, bred both forms from a single female.[4] There is good reason to believe, as Professor Punnett states,[5] that the relationship between the two forms is Mendelian, and I can now further add that there is no doubt that *mima* is dominant and *wahlbergi* recessive. This conclusion is founded on the recent experiments of my friend, Mr. W. A. Lamborn, on the corresponding forms in the Lagos district, viz., *dubia* (=*mima*) and *anthedon* (=*wahlbergi*). Details of these experiments were communicated a few weeks ago to the Entomological Society of London, and will appear in the *Proceedings* for the present year. Now for Professor Punnett's statement: "On the modern Darwinian view certain individuals of *A. dominicanus* gradually diverged from the *dominicanus* type and eventually reached the *echeria* type, though why this should have happened does not appear to be clear. At the same time those specimens [of *Euralia*] which tended to vary in the direction of *A. echeria* in places where this species was more abundant than *A. dominicanus,* were encouraged by natural selection, and under its guiding hand the form *mima* eventually arose from *wahlbergi.*

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[1] This JOURNAL, Vol. IX., pages 159–161.

[2] "Mendelism," page 134. This, at least, is the reference in the third British edition, 1911, of Professor Punnett's work. The footnote on page 160 of THE JOURNAL OF PHILOSOPHY gives page 144.

[3] *Trans. Ent. Soc. London,* pages 491–2.

[4] *Proc. Ent. Soc.,* London, 1910, pages xiv–xvi; *Trans.,* page 498.

[5] "Mendelism," page 135.

"According to Mendelian views, on the other hand, *A. echeria* arose suddenly from *A. dominicanus* (or *vice versa*), and similarly *mima* arose suddenly from *wahlbergi* (p. 134). . . . On this view the genera *Amauris* and *Euralia* contain a similar set of pattern factors, and the conditions, whatever they may be, which bring about mutation in the former lead to the production of a similar mutation in the latter" (p. 135).

Although Professor Punnett ought to be competent to express "Mendelian views," I am pretty confident that he will be unable to find a single Mendelian writer who would accept his assumption about the origin of the two species of *Amauris.* But, however this may be, it is quite certain that no Darwinian, modern or ancient, and certainly no student of insect systematics, has committed himself to the belief that one of these two Danaine models has directly arisen from the other.

The late Dr. F. Moore, in his revision of the *Danainæ,*[6] placed *echeria* and *dominicanus* in separate genera. In this he was probably wrong, but they are certainly widely separated. *Amauris niavius niavius* of the west, together with the eastern sub-species, *niavius dominicanus,* occupies an isolated position in the genus *Amauris,* and it is absurd—I can use no milder word—to suggest that *echeria* arose directly from either of them. Hence, the whole of Professor Punnett's assumption of a parallelism in origin between model and mimic, which Mr. Sumner finds so comforting, falls to the ground.

May I say in conclusion that, although the relationship between the two mimetic forms of *Euralia* is undoubtedly Mendelian, I can not believe that one of them arose suddenly from the other? I believe that any one who looks at Professor Punnett's Plate VI. will hesitate to accept the view that the details of either of the two mimetic patterns—reproducing with great precision the pattern of a species belonging to a different sub-family—arose all at once from the other by mutation.

I have, furthermore, some evidence in support of the conclusion that the origin of the mimicry was gradual. Another closely related species, *Euralia dinarcha,* presents on the west coast of Africa two forms very roughly resembling the Danaine models which are so wonderfully mimicked by the forms *anthedon* and *dubia* of the allied species. I very much hope that Mr. Lamborn will be able to breed *E. dinarcha,* and ascertain whether the Mendelian relationship exists between its two forms.[7] But whether this is so or not, there can be little doubt that these forms exhibit to us an initial stage in an evolutionary journey which has been carried very much further by *anthedon* and *dubia.*

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[6] *Proc. Zool. Soc. London,* 1883, page 201. Dr. Moore placed *echeria* and an allied species in *Nebroda.* Aurivillius in his great "Rhopalocera Æthiopica" places *niavius,* including the eastern form *dominicanus,* second and *echeria* fifteenth in the genus *Amauris.*

There are other interesting facts which remain to be further investigated in the Mendelian relationship of these mimics. Mr. Lamborn informs me that the recessive form *anthedon* shows a well-marked tendency to appear seasonally; so that, during part of the year, he finds only this form on the wing. Then, later on, *dubia* suddenly appears. Such a phenomenon is extremely difficult to explain on ordinary Mendelian lines. Either we are faced by some undiscovered aspect of Mendel's law or the dominant form must have the power of lying dormant in some one or more of its stages, and then suddenly appearing. Against this latter hypothesis is the fact that in the seven large families bred by Mr. Lamborn, and now in the Oxford University Museum, there was not the slightest evidence of any difference between the two forms in this respect.

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PROFESSOR DEWEY'S "AWARENESS"

IT is a shame to be asking Professor Dewey to take up so much time in answering what are regarded as irrelevant questions. But he has been so good in the past that I am going to take the liberty of putting two more questions. I shall put them entirely in Mr. Dewey's own words, so far as I can; and I shall request Mr. Dewey to forget, so far as this is possible, that in my former queries I seem to him to have confused his position with my own. The two questions I wish to lay before him concern the passage on the basis of which my previous unfortunate questions were raised. That passage I shall requote here so that all the data pertinent to my present inquiries may be seen at a glance: "Of course on the theory I am

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[7] Returning to Oxford at the end of the Easter vacation, I find a letter from Mr. Lamborn written March 29, 1912, from Oni Camp, near Lagos, telling me that he has now succeeded in obtaining eggs from both forms of *E. dinarcha,* and that the larvæ are doing well. We may hope for evidence, which will decide whether these two forms are a Mendelian pair, in a few weeks. I am very fortunate in having friends in the tropics who are so often able to supply us with just the very solutions for which we are looking with the utmost interest and eagerness.—E. B. P.